Invisibility Powder Concept for Providing Optical Stealth to the Warfighter Using Modified Quartz Micro-Crystals

17 August 2022
Simon Edwards
Research Acceleration Initiative

Introduction

While invisibility tarpaulins based upon the gating of light according to its angular momentum using metamaterials coupled with ultrasmooth curved parallel mirrors have shown promise for masking large, mostly round objects that can be kept free of dust and dirt (such as dirigibles,) a solution needed for providing optical stealth in an affordable and safe form for soldiers.

One day, in the not-too-distant future, we may find that the phrase, "Powder up!" has worked its way into the lexicon of the American soldier.

Abstract

In yet another novel application for solitons, this time involving visible light, I propose attempting to create a form of transient optical solitons using a solid state mechanism in order to cloak small objects and human beings using a crystalline powder with very particular properties that cause light to be modified in such a way that it passes through the body and normalizes after a few feet, thus creating the illusion that nothing is there at all. Members of the same platoon, therefore, could see each other at very close range since the Transiently Solitonized Light (TSL) would not have yet had an opportunity to normalize.

How can this be achieved? Ordinarily, soliton waves are meant to be durable and to travel hundreds of miles. They would normally be generated using rings of powerful electromagnets of alternating polarity in each pie slice of a flat wave, which serves the dual purpose of assuring that spins alternate and all of the electrons in that wave are next to one another and none travel behind one another.

This raised the question as to whether it would be possible to achieve something similar with light in the visible spectrum using a solid state mechanism. The answer would seem to be, "Yes."

For light to be solitonized in the desired manner, small quanta of light must be accumulated as they enter a each micro-crystal (the properties of a transparent crystal like quartz lend themselves to light-handling) and the crystal must then fundamentally achieve two things to meet this objective: It must intermittently (on the scale of about once per femtosecond) accumulate and release photons as well as modify their spin properties in a solid state mechanism.

To achieve this on such a rapid timescale, each individual crystal must slow the passage of light until the shape of the crystal is altered by reverse electrostrictive effects (the same effect that governs the timing of quartz

chronographs,) at which point, the photons then virtually neck-and-neck with each other, would be ejected at the same moment, compressed in terms of their placement but not having had their property of frequency permanently altered. In a true soliton wave, there is no property of frequency or phase. In this case, our crystal really does not have the power necessary to achieve this and we only want to bring the light part way toward being a soliton. The idea, after all, is for light entering on one side of the body to pass through it while in a state in which it tends not to interact with even most solid objects, and ultimately for the light to self-repel through the Coulomb force, returning to its original visual pattern and frequency.

This can be achieved by structuring the crystal so that light retains its frequency (optical clarity) but so that light is physically slowed in terms of its passage, causing some of the light to nearly catch up with the first light to enter the crystal. This can be possible if the crystal's tendency toward slowing light can, by design, increase the more the total electrical content is. The quality comes naturally to quartz, with existing crystals oscillating in as high as the megahertz range. The quantity of electricity involved would be infinitesimal by comparison to normal quartz operation and the frequency at which light would have to be collected and "dumped" would be in the terahertz range rather than megahertz. This difference can be achieved by synthesizing crystals with lattices of higher density by altering the manufacturing process accordingly.

That design element accounts for only one of two things our crystal must do to solitonize the light. The rounded (both to prevent skin abrasions and because the technique calls for round-shaped walls of EM) crystals must also be capable of using innate magnetism to get photons spinning toward the center of the crystal and so that neighboring slices of that round wall of EM spin in a relative counter-clockwise orientation relative to their neighbors, but always with their spin pathway pointing toward center. This may be easier than it sounds since quartz can be synthesized in a variety of ways and the internal structure of the quartz can be changed using high pressures. A simple magnetic additive could be used to dope the crystal to bestow it with the needed magnetic properties.

As for the specific structure, given that quartz has a naturally hexagonal structure, it makes sense that our crystal would have six distinct "slices." Although having more slices would result in a more durable soliton wave, for our purposes, we don't want the solitons to be too durable since that would result in enemy soldiers seeing our cloaked soldiers as a dark silhouette rather than not seeing them at all.

In each hexagonal micro-crystal, the magnetic doping means that a modest magnetic force is applied to any light passing through that section of the crystal wherein the "North" polarity is pointing toward the center of the pie slices in every other slice and "South" points toward center in every remaining slice.

Conclusion

The net result of this would be that anyone cloaked in a fine powder of billions

of these crystals would be essentially invisible, with the crystals effortlessly accumulating, modifying, and bursting TSL capable of penetrating the thickness of the human body but ultimately becoming visible again before reaching the eyes of the enemy. Quartz, which is the second most abundant mineral on Earth, would make an ideal basis for such a synthetic optical material given its low cost and the many years of experience we already have with the material.